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Analysis of Stock Size and Yield of East Coast Newfoundland Herring Stock

by

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Abstract

The assessment considered east coast Newfoundland herring as four stock complexes: 1) White Bay - Notre Dame Bay, 2) Bonavista Bay, 3) Trinity Bay, and 4) Conception Bay - Southern Shore. It summarizes the results of data collected in 1979 and presents a short-term prognosis of yield and abundance. Total landings reached a high of 26,300 t in 1979, 70% of which was caught by inshore gears (gillnets, bar seines, and traps). In all areas the 1968 and 1969 year-classes continued to support the fishery with over 80% of the catch age 10+. Age specific weights and partial recruitment rates were the same as those used in the previous assessment of these stocks (Winters and Moores, 1979).

Catch rate information was obtained from sales slip records for both the ringnet fleet and gillnet components of the fishery. The linear formula of Paloheimo (1961) was used to calculate total mortality coefficients (Z) for age groups 5+. Trial runs of the cohort analysis were made to obtain the best estimates of terminal fishing mortality (F_t) for each of the Z's calculated. The highest estimates of F_t were used in the assessment. The results of the assessment showed that biomass levels are decreasing and the level of fishing mortality is increasing. Recruitment throughout the area has been uniformly poor since the 1968 and 1969 year-classes. Due to the depleted nature of the stocks, projections were made at F = 0.30, lower than the $F_{0.1}$ level (0.40) used in the previous assessment. Catch projections were made for each stock area for 1980 and 1981. Due to the uncertainty in the choice of F_t's, it was not possible to distinguish between 13,400 t predicted for 1980 in this year's assessment and the 9,300 t projected for 1980 in last year's assessment.

Résumé

Dans la présente évaluation, nous considérons le hareng de la côte orientale de Terre-Neuve formé de quatre complexe de stocks: 1) baie Blanche - baie Notre-Dame, 2) baie Bonavista, 3) baie de la Trinité et 4) baie de la Conception - côte Sud. Nous résumons les résultats des données recueillies en 1979 et faisons des prévisions à court terme de rendement et d'abondance. Les débarquements totaux atteignirent un sommet de 26 300 t en 1979, 70% étant capturés par des engins de pêche

côtière (filets maillants, sennes de barrage et trappes). Dans toutes les régions, les classes d'âge de 1968 et 1969 continuent d'alimenter la pêcherie, 80% des prises étant d'âge 10+. Les poids à un âge donné et les taux de recrutement partiel sont les mêmes que ceux qui ont servi dans l'évaluation précédente de ces stocks (Winters et Moores, 1979). L'information sur le taux de capture provient des comptes de vente, tant pour la flottille de pêche à la senne coulissante que pour les prises des filets maillants. La formule linéaire de Paloheimo (1961) a été utilisée dans le calcul des coefficients de mortalité totale ($\bar{z}$) pour les groupes d'âge 5+. Les meilleures estimations du taux de mortalité terminal (F_t) pour chacun des $\bar{z}$ calculés ont été obtenues à la suite de calculs d'essai d'analyse des cohortes. Nous avons choisi, pour l'évaluation, les estimations les plus élevées de F_t. Les résultats démontrent que la biomasse diminue et que la mortalité par pêche augmente. Depuis les classes d'âge de 1968 et 1969, le recrutement dans toute la région a été uniformément pauvre. À cause de l'appauvrissement des stocks, nous faisons des prévisions pour F = 0.30, soit un niveau inférieur à celui de $F_{0.1}$ (0.40) utilisé dans l'évaluation précédente. Des prévisons de capture ont éte faites pour chaque région en 1980 et 1981. A cause de l'incertitude du choix des F_t, il a été impossible de faire la distinction entre les 13 000 t prédites pour 1980 dans l'évaluation de la présente année et les 9 800 t prédites pour 1980 dans l'évaluation de l'année dernière.

INTRODUCTION

Herring landings along the east coast of Newfoundland remained relatively low (<10,000 mt) prior to the 1970's. With the development of a small purse-seine fleet in the early 1970's, landings increased to 25,700 mt in 1977. An analytical assessment (Winters and Moores, 1977) indicated that the east coast herring were predominantly spring-spawners which had greatly increased in abundance during the early 1970's, as a result of the production of a very strong year-class in 1968 and a somewhat weaker one in 1969. A subsequent assessment (Winters and Moores, 1979) indicated that recruitment has been uniformly poor throughout the area since the 1968 and 1969 year-classes.

This document follows last year's assessment (Winters and Moores, 1979) and considers east coast Newfoundland herring as four stock complexes: 1. White Bay-Notre Dame Bay; 2. Bonavista Bay; 3. Trinity Bay and, 4. Conception Bay-Southern Shore. It summarizes the results of data collected in 1979 and presents a short term prognosis of yield and abundance.

Recent Catch Statistics

Total landings reached 25,700 mt in 1977 (Table 1), declined to 22,100 mt in 1978 and increased to a high of 26,300 mt in 1979. Inshore landings (gillnets, bar seines, and traps) have increased dramatically over the last three years, accounting for 38% of the total catch in 1977, 50% of 1978, and 70% of 1979.

Age Composition Data

Age composition of commercial catches of herring in the various east coast bays are shown in Fig. 2. In all cases the 1968 year-class continues to support the fishery, with over 70% of the catch age 11+ in Bonavista, Trinity and Conception Bays. In White Bay and Notre Dame Bay, the 1969 year-class contributes approximately 30% to the catch. All subsequent year-classes up to and possibly including the 1977 year-classes are weak.

Assessment Parameters

Age Specific Weights: Average weights-at-age as derived from biological samples taken in the first two quarters of the year from each defined stock area were compared with those of Winters and Moores (1979). As there was little difference, age specific weights (Table 2) have not been changed from last year's assessment.

Partial Recruitment Rates: Trial runs of cohort analysis were used as a basis for evaluating the age specific selectivity pattern for each defined stock. These were compared with the values obtained by Winters and Moores (1979). No significant changes were discernible; therefore, the partial recruitment rates used in initiating cohort analysis were identical to those used in the previous two assessments of these stocks.

CPUE Analysis: Detailed catch rate information in log book form for the ringnet fleet operating along the east coast was obtained for the first time in 1979 and is presented in Table 3. Catch-per-trip data are available from sales slip records for each defined stock area for the period 1976-79 (Tables 4-7). Similar to Winters and Moores (1979), the fleet was broken down into the following five categories to allow more detailed evaluation of catch trends in relation to potential learning factors:

Category A: large (60-65') ringnetters with experienced crews fishing from 1976-79.

Category B: vessels which participated in the ringnet fishery for all four years (1976-79).

Category C: vessels which participated in the ringnet fishery for three years (1977-79).

Category D: vessels which fished for two years.

Category E: vessels which entered the fishery for the first time in 1979.

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Catch rate information was calculated for the first time for the gillnet component of the fishery; catch-per-landing data were compiled from sales slip records for fishermen common over the period 1977-79 for each defined stock area (Tables 8-11).

Calculation of Terminal Fishing Mortality (F): The linear formula of Paloheimo (1961) has been used to calculate the total mortality coefficients ($\bar{z}$) for age groups 5+ for 1977-78, 1978-79, and 1977-79 based on catch-per-trip by each vessel category of the ringnet fleet according to common periods (months) fished in 1977-79. In addition, all available data for each vessel category and all months of the year have been used to calculate mortality coefficients (Table 12). Whereever possible, mortality coefficients derived from vessel categories A and B were used. No weighting factors were attached to their estimates of $\bar{z}$ as learning factors of these two categories would be similar from 1978-79. Similarly, mortality coefficients were calculated for the gillnet component from the catch-per-landing data (Table 13). Mortality coefficients ($\bar{z}$) were calculated for ages 5+ for 1977-78, 1978-79, and 1977-79 based on common fishermen and according to common periods (months) fished in 1977-79. To allow for changes in the number of gillnets used over the three year period, each fisherman was contacted and asked how many nets he had fished each year. Catches were standardized and catch-per-landing data were then calculated. For areas A and B, which consist of three statistical areas (339-341), catch-per-landing data were indexed for each statistical area, the indices were averaged, and this average index was used to calculate effort. Trial runs of the cohort analysis were made to obtain the best estimates of terminal

fishing mortality (F_t) for each of the Z's calculated. The estimates of F_t derived from ringnet and gillnet data were compared for each unit stock area. Generally, the F_t derived from gillnet data for 1978-79 was the highest and considered the best estimate except for areas E&F where the F_t derived from ringnet data for 1977-79 was used. Therefore, the estimates of F for 1979 are as follows:

Area	A&B	C	D	E&F
F	0.40	0.30	0.30	0.20

It was considered that these estimates may have underestimated the actual fishing mortality in 1979. Projections using the other estimates of F_t are included in this report (Appendixes 1-10).

Results of the Assessment

Trends in Biomass and F: Biomass levels are decreasing in all stock areas of the east coast of Newfoundland (Tables 14-25) (Fig. 3). The highest biomass levels occurred in 1971 in areas A, B, C, and D and in 1970 in areas E&F with the recruitment of the strong 1968-69 year-classes. The 1979 biomass levels are the lowest observed for the time series.

The level of fishing mortality (F_{5+}) shows an increase in 1979 in all areas except E&F (Tables 14-25). Unlike previous years, when the highest F values were recorded for the southern areas, the highest F in 1979 was recorded for White Bay-Notre Dame Bay. This was due to the rapid increase in the gillnet component of the fishery in the area.

Trends in Recruitment: Since the 1968 and 1969 year-classes, recruitment has been uniformly poor throughout the area (Fig. 4). The 1974 year-class initially appeared to be of moderate strength but does not now contribute significantly to the catch in any area. The 1976 year-class which contributed in some strength last year in Trinity Bay and Bonavista Bay now shows up only in Bonavista Bay where it represents 60% of the strength of the 1968 year-class.

Estimation of $F_{0.1}$: Since there were no changes in the average weight-at-age and mean recruitment rate from last year's assessment, yield-per-recruit curves were not constructed. Due to the depleted nature of the stocks, projections were made at F = 0.30, lower than the $F_{0.1}$ level (0.40) used last year.

Catch Projections: Catch projections were performed separately for each stock area for 1980 and 1981 (Tables 26-29). Recruitment was held constant at a level approximately the geometric mean recruitment at age 2 of all year-classes observed omitting the large 1968 year-class. The recruitment values were as follows:

Area	A&B	C	D	E&F
Recruitment ($x10^{-6}$)	20.0	10.0	1.5	1.5

The 1980 catch was adjusted by the correction factor required to make the calculated 1979 catch weight equivalent to the actual 1979 catch weight.

Area	A&B	C	D	E&F
1980 catch (adj.)	7,300	4,350	2,200	900
1979 TAC	11,500	5,400	3,000	900

Due to the uncertainty in the choice of F_t's, it was not possible to distinguish between the 13,400 t predicted for 1980 in this year's assessment and the 9,800 t projected for 1980 in last year's assessment.

Projections were made for each area for 1981, allowing a TAC of 9,800 t in 1980 and using the reduced F values associated with taking this 1980 TAC. The results of the projections are shown below for each defined stock area.

Unit Area	A&B		C		D		E&F	
	1980	1981	1980	1981	1980	1981	1980	1981
Age 2+ Biomass ('000 t)	31.7	21.4	19.0	15.0	9.3	6.6	3.4	2.7
Catch ('000 t)	5.0	3.5	3.0	2.3	1.4	0.9	0.4	0.3
F	0.21		0.24		0.18		0.16	

DISCUSSION

In previous years, the implementation of quotas affected only the ringnet component of the east coast Newfoundland herring fishery. In 1980, both inshore and ringnet components will be under quota which should reduce the overriding of quotas experienced in previous years. The lack of recruitment since 1968-69 is the major problem concerning the east coast herring stocks. Initial reports from fishermen in Bonavista and Notre Dame Bays suggest that the 1979 year-class may represent some strength.

REFERENCES CITED

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Table 1. East Coast herring catches (metric tons) by area and gear 1973-79.

Year	Gear	A	B	C	D	E & F	Total
1973	Inshore	816	1658	504	544	1098	4620
	Ring net	-	-	-	-	-	-
	Purse seine	1	1	5	156	211	374
	TOTAL	817	1659	509	700	1309	4994
1974	Inshore	1423	2588	642	1223	536	6412
	Ring net	8	6	-	428	2107	2549
	Purse seine	-	-	-	-	48	48
	TOTAL	1431	2594	642	1651	2691	9009
	Inshore	1584	1852	450	743	893	5522
	Ring net	-	108	-	1790	2596	4494
	Purse seine	828	1183	1559	1370	13	4953
	TOTAL	2412	3143	2009	3903	3502	14969
1976	Inshore	773	3184	491	914	737	6099
	Ring net	487	3412	3052	1054	1748	9753
	Purse seine	1724	2908	2812	1614	-	9058
	TOTAL	2984	9504	6355	3582	2485	24910
1977	Inshore	552	4893	2808	1145	461	9859
	Ring net	1227	4922	6204	1548	1716	15617
	Pair trawl	-	-	236	-	-	236
	TOTAL	1779	9815	9248	2693	2177	25712
1978	Inshore	1750	5918	1338	1242	778	11026
	Ring net	1148	3467	4203	1045	1255	11118
	TOTAL	2898	9385	5541	2287	2033	22144
1979	Inshore	1051	11843	2721	2350	451	18416
	Ring net	832	1968	3490	1181	442	7913
	TOTAL	1883	13811	6211	3531	893	26329

1979 figures are provisional

No purse seine landings after 1976

Table 2. Average weight-at-age (gm) of Newfoundland east coast herring in 1978-79.

Age	Area			
	A&B	C	D	E&F
2	80	80	80	80
3	133	133	146	170
4	201	191	220	236
5	242	253	248	264
6	253	258	259	276
7	266	264	272	292
8	271	270	278	297
9	275	285	286	307
10	279	287	305	331
11+	311	322	348	361

Table 3. Monthly CPUE data (catch/set) as evaluated from log records of ringnetters operating along the east coast of Newfoundland in 1979.

Area	Catch-per-unit-effort			Unweighted mean April-October
	April	August	October	
A&B	15.2	3.0	8.1	8.8
C	13.2	-	3.5	8.4
D	3.7	-	-	3.7
E&F	3.7	-	-	3.7
Unweighted mean	9.0	3.0	5.8	

Table 4. Catch-per-unit-effort indices for the various vessel categories for statistical areas 335-336 (E&F).

Vessel Category	Year	Catch-per-trip (m tons) April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Unweighted average
A	1976	-	47.4	53.0*	-	-	-	-	-	-	-	47.4
	1977	37.6	12.0	11.5*	-	-	-	-	-	-	-	24.8
	1978	22.2	-	-	-	-	-	-	-	-	-	22.2
	1979	20.6*	-	-	-	-	-	-	-	-	-	-
B	1976	-	15.0	13.5	7.6	6.7	6.5	-	14.8	12.0*	-	10.7
	1977	13.0	18.2	19.7	-	-	3.0*	14.0*	-	-	-	17.0
	1978	-	-	-	-	-	8.5	-	-	-	-	8.5
	1979	10.7	-	-	-	-	-	-	-	-	-	10.7
C	1976	-	-	-	-	-	-	-	-	-	-	-
	1977	-	15.7	21.0	-	-	-	-	-	-	-	18.4
	1978	7.0	-	-	-	-	11.0	2.0*	-	-	-	9.5
	1979	11.2	-	-	-	-	-	-	-	-	-	11.2
D	1976	-	13.9	14.4	21.0	9.5	5.7	-	14.0	-	-	13.1
	1977	-	9.0*	14.0*	-	-	-	-	-	-	-	-
	1978	11.0	-	-	-	-	10.3	-	-	-	-	10.7
	1979	12.9	-	-	-	-	-	-	-	-	-	12.9
E	1976											
	1977											
	1978											
	1979	9.4	-	-	-	-	-	-	-	-	-	9.4
Unweighted average		15.0	20.4	17.2	14.3	8.1	8.4	-	14.4	-	-	

* less than 3 trips

Table 5. Catch-per-unit-effort indices for the various vessel categories [illegible] statistical area 337 (D).

Vessel Category	Year	Catch-per-trip (m tons) April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Unweighted average
A	1976	-	-	-	-	-	-	-	-	-	-	-
	1977	-	-	-	-	-	-	-	-	48.0	-	48.0
	1978	-	-	-	-	-	-	-	-	-	20.5	20.5
	1979	38.9	-	-	-	-	-	-	16.7	22.6	-	26.1
B	1976	3.0	5.5	-	-	-	6.0*	8.4	13.5	16.9	-	9.5
	1977	11.6	11.8	4.3	-	3.0	6.6	9.0	8.2	-	-	7.8
	1978	5.3	-	-	-	-	8.5	9.0*	12.0*	-	-	6.9
	1979	7.5	0.9*	-	-	-	-	-	-	14.1	-	10.8
C	1976	-	-	-	-	-	-	-	-	-	-	-
	1977	-	-	-	-	-	-	-	12.0*	-	-	-
	1978	-	-	-	0.2*	-	-	-	-	-	-	-
	1979	-	-	-	-	-	-	-	-	-	-	-
D	1976	1.0	-	7.5	-	-	-	8.0	14.6	4.0*	-	7.8
	1977	-	-	-	-	-	8.0	-	11.0*	-	-	8.0
	1978	3.8	1.9	-	-	4.0	2.7	-	-	-	-	3.1
	1979	12.2	-	-	-	-	-	-	41.9*	23.6*	-	12.2
E	1976											
	1977											
	1978											
	1979	17.5*	-	-	-	-	-	-	-	-	-	-
Unweighted average		11.2	6.4	5.9		3.5	6.5	8.5	13.3	25.4	20.5	

* less than 3 trips

Table 6. Catch-per-unit-effort indices for the various vessel categories for statistical area 338 (C).

Vessel Category	Year	Catch-per-trip (m tons) April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Unweighted average
A	1976	-	-	-	-	-	-	-	-	-	-	-
	1977	-	-	-	-	-	-	27.2	36.0	-	-	31.6
	1978	-	-	-	-	-	-	16.9	-	-	-	16.9
	1979	10.5	-	-	-	-	-	19.5	-	-	-	15.0
B	1976	-	-	-	-	-	1.0	11.9	13.4	6.0	-	8.1
	1977	10.7	12.0	24.0	-	-	4.7	15.1	15.4	29.5	-	15.9
	1978	11.5	6.1	-	-	-	2.1	9.0	5.3	-	-	6.8
	1979	11.9	-	-	-	-	-	7.0	-	-	-	9.5
C	1976	-	-	-	-	-	-	-	-	-	-	-
	1977	2.0	3.7	-	-	-	3.5	16.9	15.4	-	-	8.3
	1978	9.9	-	-	-	-	2.8	12.1	-	-	-	8.3
	1979	10.2	-	-	-	-	-	8.8	-	-	-	9.5
D	1976	-	-	-	-	-	-	9.1	19.1	-	-	14.1
	1977	-	-	-	-	-	-	9.6	10.6	-	-	10.1
	1978	16.6	-	-	-	-	-	8.7	-	-	-	12.7
	1979	10.5	-	-	-	-	-	8.1	-	-	-	9.3
E	1976											
	1977											
	1978											
	1979	10.3	-	-	-	-	-	11.9	-	-	-	11.1
Unweighted average		10.4	7.3	24.0	-	-	2.8	12.8	16.5	17.8	-	

* less than 3 trips

Table 7. Catch-per-unit-effort indices for the various vessel categories for statistical areas 339-341 (A&B).

Vessel Category	Year	Catch-per-trip (m tons)										Unweighted average
		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	
A	1976	-	-	-	-	-	8.0*	34.9	39.2	43.1	-	38.9
	1977	-	28.6	-	-	-	-	38.8	-	-	-	33.7
	1978	-	-	-	-	-	39.9	26.1	-	-	-	33.0
	1979	-	-	-	-	18.5	-	20.7	-	-	-	19.6
B	1976	-	15.1	23.9	-	-	26.5	20.5	19.0	28.0	-	22.2
	1977	2.0*	15.6	26.3	-	3.7	21.8	15.4	-	-	-	16.6
	1978	4.2	4.7	15.3	-	3.7	18.2	15.3	10.8	-	-	10.3
	1979	18.9	-	6.8*	-	22.7	-	19.9	-	-	-	20.5
C	1976	-	-	-	-	-	-	-	-	-	-	-
	1977	12.2	11.9	9.8	-	4.8	11.2	15.7	-	-	-	10.9
	1978	11.3	7.9	7.2	-	2.6	12.2	12.4	-	-	-	8.9
	1979	17.8	-	20.5*	-	19.0	-	13.4	-	-	-	16.7
D	1976	-	7.5	15.0	-	-	-	7.7	16.8	-	-	11.8
	1977	4.0*	12.6	28.0	-	-	8.5	12.8	-	-	-	15.5
	1978	-	1.8	18.9	-	4.2	3.3	11.7	11.0	-	-	8.5
	1979	-	-	-	-	9.3	-	18.6*	-	-	-	9.3
E	1976											
	1977											
	1978											
	1979	23.4*	-	-	-	13.0	-	16.0	-	-	-	14.5
Unweighted average		12.9	11.7	18.1	-	10.2	17.7	18.7	19.4	35.6	-	

* less than 3 trips

Table 8. Catch-per-unit-effort indices (# of landings/total catch (lbs)/ catch per landing (lbs) for common gillnet fishermen, 1977-79, for statistical areas 335-336 (Conception Bay-Southern Shore).

Year	April	May	June	All
1977	32/65929/2060	22/62058/2821	8/14754/1844	62/142741/2302
1978	12/8296/691	25/34513/1381	2/2126/1063	39/44935/1152
1979	11/21753/1978	9/8328/925	2/361/181	22/30442/1384

Table 9. Catch-per-unit-effort indices (# of landings/total catch (lbs)/ catch per landing (lbs) for common gillnet fishermen, 1977-79, for statistical area 337 (Trinity Bay).

Year	April	May	All
1977	32/21470/671	10/6283/628	42/27753/661
1978	17/14960/880	12/9325/777	29/24285/837
1979	7/3185/445	13/8322/640	20/11507/575

Table 10. Catch-per-unit-effort indices (# of landings/total catch (lbs)/ catch per landing (lbs) for common gillnet fishermen, 1977-79, for statistical area 338 (Bonavista Bay).

Year	May	November	All
1977	4/3155/789	3/17595/5865	7/20750/2964
1978	4/2856/714	40/55573/1389	44/58429/1328
1979	13/19707/1516	73/68211/934	86/87918/1022

Table 11. Catch-per-unit-effort indices (# of landings/total catch (lbs)/catch per landing (lbs) for common gillnet fishermen, 1977-79, for statistical areas 339-341 (White Bay-Notre Dame Bay).

Area	Year	Month					
		February	March	April	May	All	
339	1977	43/86452/2011	119/358019/3009	29/76081/2623	104/307557/2957	295/828109/2807	
	1978	60/132850/2214	100/211601/2116	96/182507/1901	75/135366/1805	331/662324/2001	
	1979	84/130027/1548	142/253287/1784	118/178658/1514	11/16742/1522	355/578714/1630	
		May	June	October	November	December	All
340	1977	13/12779/983	16/18937/1184	25/37771/1511	35/59945/1713	2/1588/794	91/131020/1440
	1978	8/6832/854	12/8353/696	91/157327/1729	40/85426/2136	9/23915/2657	160/281853/1762
	1979	1/310/310	12/13915/1160	63/55337/878	21/19316/920	10/8816/882	107/97674/913
		May	June	October	November	All	
341	1977	11/11916/1083	14/34435/2460	1/68/68	23/26441/1150	49/72860/1487	
	1978	96/63636/663	108/64676/599	38/25931/682	29/39019/1345	271/193262/713	
	1979	64/49962/781	41/29348/716	89/36361/409	66/18922/287	260/134593/518	

Table 12. Calculation of instantaneous total mortality rates (Ż) from catch-per-unit-effort indices of the ringnet fleet operation along the east coast of Newfoundland, 1977-79.

Areas	Vessel Cat.	Month Sel.	Catch/trip (m tons)			f			Ż			F_t	
			1977	1978	1979	1977	1978	1979	1977 -78	1978 -79	1977 -79	1978 -79	1977 -79
A&B (339-341)	A	Oct.	38.8	26.1	20.7	298.8	470.6	758.2	0.38	0.30	0.69	0.13	0.23
	B	Aug.	3.7	3.7	22.7	3133.5	3319.7	691.4	-0.01	-1.75	-1.75	-	-
	B	Oct.	15.4	15.3	19.9	752.9	802.8	788.6	-0.01	-0.20	-0.20	-	-
	C	Apr.	12.2	11.3	17.8	950.3	1087.0	881.7	0.06	-0.39	-0.32	-	-
	C	Aug.	4.8	2.6	19.0	2415.4	4724.2	826.0	0.60	-1.92	-1.32	-	-
	C	Oct.	15.7	12.4	13.4	738.5	990.6	1172.2	0.22	-0.01	0.22	-	-
	All	All	16.3	11.6	17.2	711.3	1058.9	912.4	0.33	-0.33	0.01	-	-
C (338)	A	Oct.	27.2	16.9	19.5	340.0	327.9	318.5	0.47	0.02	0.49	-	0.05
	B	Apr.	10.7	11.5	11.9	864.3	481.8	521.9	-0.07	0.13	0.05	-	-
	B	Oct.	15.1	9.0	7.0	612.5	615.7	887.3	0.51	0.42	0.93	0.28	0.36
	C	Apr.	2.0	9.9	10.2	4624.0	559.7	608.9	-1.60	0.14	-1.47	-	-
	C	Oct.	16.9	12.1	8.8	547.2	457.2	705.8	0.33	0.48	0.81	0.35	0.27
	D	Oct.	9.6	8.7	8.1	963.3	636.9	766.8	0.10	0.24	0.33	-	-
	All	All	14.8	9.2	10.9	624.9	602.3	559.8	0.47	-0.01	0.46	-	0.03
D (337)	A	Dec.	48.0	-	22.6	56.1	-	156.2	-	-	0.85	-	0.41
	B	Apr.	11.6	5.3	7.5	232.2	431.5	470.8	0.86	-0.32	0.59	-	0.16
	D	Apr.	-	3.8	12.2	-	601.8	289.4	-	-1.14	-	-	-
	All	All	12.3	6.7	18.7	218.9	341.3	188.8	0.68	-1.00	-0.32	-	-
E&F (335-336)	A	Apr.	37.6	22.2	20.6	57.9	91.6	43.3	0.75	0.22	0.97	-	0.20
	C	Apr.	-	7.0	11.2	-	290.4	79.7	-	-0.32	-	-	-
	D	Apr.	-	11.0	12.9	-	184.8	69.2	-	-0.01	-	-	-
	All	All	22.9	11.7	11.1	95.1	173.8	80.5	0.89	0.20	1.09	-	0.26

Table 13. Calculation of instantaneous total mortality rates (Z) from catch-per-unit-effort indices of the gillnet component along the east coast of Newfoundland, 1977-79.

Areas	Catch/landing (m tons)			Indices			Avg. index			f			Z			F_t	
	1977	1978	1979	1977	1978	1979	1977	1978	1979	1977	1978	1979	1977-78	1978-79	1977-79	1978-79	1977-79
A&B																	
339	1.28	0.91	0.74	1.00	0.71	0.58											
340	0.65	0.80	0.42	0.82	1.00	0.52	0.94	0.73	0.43	12334	16826	32696	0.24	0.49	0.73	0.39	0.26
341	0.68	0.32	0.24	1.00	0.48	0.35											
C 338	1.35	0.60	0.46	-	-	-	-	-	-	6850	9235	13502	0.81	0.43	1.23	0.28	0.65
D 337	0.30	0.38	0.26	-	-	-	-	-	-	8977	6018	13581	-0.16	0.40	0.24	0.28	-
E&F 336	1.05	0.52	0.63	-	-	-	-	-	-	2073	3910	1417	0.93	-0.04	0.88	-	0.16

Table 14. Catch numbers ($x10^{-4}$) for areas A and B, 1969-79.

Age	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
2	-	1	-	1	-	-	-	12	5	-	-
3	5	-	30	29	73	1	13	3	170	6	5
4	10	1	5	245	150	12	22	61	11	204	71
5	2	3	16	36	294	318	46	25	47	32	87
6	14	3	6	7	78	552	546	82	18	104	65
7	-	99	43	13	74	120	709	1028	80	52	105
8	11	1	1013	41	68	70	112	1638	738	251	210
9	1	9	24	139	42	151	84	130	1270	1082	661
10	6	16	28	21	171	86	81	330	106	1177	1421
11+	5	29	315	83	88	236	400	827	1572	1440	2482
Total	54	162	1480	614	1038	1546	2013	4136	4017	4348	5107

Table 15. Fishing mortality rate for areas A and B, 1969-79.

Age	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
2	.000	.000	.000	.000	.000	.000	.000	.010	.005	.000	.004
3	.000	.000	.001	.001	.009	.000	.012	.008	.182	.006	.020
4	.002	.000	.002	.009	.007	.002	.014	.075	.033	.345	.100
5	.000	.000	.002	.015	.013	.018	.009	.019	.075	.126	.240
6	.001	.000	.001	.001	.041	.031	.039	.020	.018	.238	.400
7	.000	.007	.007	.003	.011	.081	.051	.095	.024	.065	.400
8	.018	.001	.091	.009	.023	.013	.101	.160	.092	.099	.400
9	.000	.018	.021	.016	.011	.064	.020	.162	.180	.188	.400
10	.002	.008	.074	.023	.025	.028	.044	.100	.192	.252	.400
11+	.004	.008	.070	.022	.023	.028	.044	.099	.191	.246	.400
F_2+	.001	.002	.014	.006	.013	.024	.038	.100	.128	.196	.371
F_5+	.001	.005	.039	.011	.017	.027	.040	.104	.133	.204	.395

Table 16. Population numbers ($x10^{-5}$) for areas A and B, 1969-79.

Age	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
2	493	4512	3632	1048	260	142	57	140	124	36	3
3	1624	403	3694	2974	858	213	116	46	113	101	30
4	749	1329	330	3022	2432	696	171	94	38	77	82
5	955	612	1088	270	2452	1978	569	141	71	30	45
6	1926	782	501	889	218	1981	1590	461	113	54	22
7	186	1576	640	410	728	171	1572	1253	370	91	35
8	67	152	1281	520	334	589	129	1223	933	296	70
9	262	54	125	957	422	268	476	96	853	697	220
10	361	214	43	100	771	342	205	382	67	583	473
11+	152	418	514	425	420	952	1030	968	1001	722	825
Total	6775	10054	11849	10615	8895	7331	5918	4803	3683	2688	1803
B_2+	1412	1693	1962	2050	2018	1829	1557	1286	994	736	514
B_5+	1006	1011	1114	964	1395	1650	1502	1249	961	704	493

(B_2+ and B_5+: m tons x 10^{-2})

Table 17. Catch numbers ($x10^{-4}$) for area C, 1969-79.

Age	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
2	-	-	-	-	-	-	-	-	2	1	1
3	-	-	11	1	-	-	35	7	22	3	28
4	-	-	7	38	2	-	8	30	12	34	17
5	-	-	1	21	80	-	10	10	72	12	62
6	5	-	1	1	30	13	114	10	18	23	2
7	-	22	3	4	1	5	360	341	4	11	30
8	1	-	36	4	8	3	14	1292	492	57	9
9	-	7	-	31	8	10	46	64	1781	291	32
10	1	1	9	-	60	2	23	62	69	865	319
11+	4	7	10	14	25	23	85	254	423	471	1252
Total	11	37	78	114	214	56	695	2070	2895	1768	1752

Table 18. Fishing mortality rate for area C, 1969-79.

Age	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
2	.000	.000	.000	.000	.000	.000	.002	.000	.005	.000	.003
3	.000	.000	.000	.000	.000	.001	.077	.144	.036	.009	.015
4	.000	.000	.003	.002	.000	.000	.056	.087	.400	.071	.075
5	.000	.000	.000	.013	.004	.000	.024	.097	.309	.894	.180
6	.001	.000	.000	.000	.023	.001	.026	.031	.251	.150	.300
7	.001	.004	.007	.003	.001	.005	.028	.100	.016	.224	.300
8	.001	.001	.007	.011	.006	.002	.016	.132	.204	.321	.300
9	.001	.006	.002	.008	.026	.009	.046	.099	.272	.178	.300
10	.001	.005	.009	.008	.018	.006	.026	.081	.147	.205	.300
11+	.004	.005	.007	.007	.016	.006	.026	.078	.143	.196	.300
F_2+	.001	.001	.001	.003	.006	.002	.028	.107	.208	.150	.214

Table 19. Population numbers ($x10^{-5}$) for area C, 1969-79.

Age	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
2	324	3958	1110	81	24	64	7	84	39	256	22
3	379	266	3240	909	67	19	53	6	69	31	210
4	322	311	217	2652	744	55	16	40	4	54	25
5	80	264	254	177	2168	609	45	12	30	2	41
6	823	65	216	208	143	1768	499	36	9	18	1
7	12	674	53	177	170	115	1446	398	28	6	13
8	162	9	550	43	144	139	93	1151	295	23	4
9	16	133	7	447	35	117	114	75	826	197	14
10	110	13	108	6	363	28	95	89	56	515	135
11+	92	165	145	206	172	430	373	373	350	288	530
Total	2320	5856	5901	4906	4030	3345	2740	2264	1705	1390	995
B_2+	483	770	924	986	992	876	737	611	474	345	263
B_5+	355	358	362	352	839	858	727	596	461	309	228

(B_2+ and B_5+: m tons x 10^{-2})

Table 20. Catch numbers ($x10^{-4}$) for area D, 1969-79.

Age	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
2	-	-	-	-	-	-	-	1	-	1	-
3	1	-	31	-	-	-	4	1	3	-	-
4	-	1	16	98	6	-	6	20	2	2	-
5	1	1	1	19	283	24	7	2	4	-	14
6	24	6	1	9	8	472	144	7	4	2	-
7	-	65	17	3	5	39	1077	153	1	1	14
8	3	4	69	5	-	13	32	790	129	2	1
9	3	7	13	17	3	20	54	27	525	136	21
10	2	7	3	1	16	5	51	24	26	438	238
11+	24	17	30	9	1	63	84	179	160	91	734
Total	58	108	181	161	322	636	1459	1204	854	673	1022

Table 21. Fishing mortality rate for area D, 1969-79.

Age	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
2	.000	.000	.000	.000	.003	.001	.017	.007	.045	.048	.003
3	.001	.000	.001	.000	.000	.003	.029	.237	.023	.058	.015
4	.000	.001	.022	.006	.001	.001	.257	.175	.885	.020	.075
5	.003	.001	.002	.032	.020	.007	.034	.122	.052	.101	.180
6	.007	.023	.001	.019	.017	.043	.053	.045	.478	.025	.300
7	.011	.025	.087	.003	.014	.110	.130	.073	.007	.110	.300
8	.082	.136	.033	.031	.000	.043	.122	.133	.081	.018	.300
9	.057	.295	.957	.010	.021	.029	.259	.145	.123	.115	.300
10	.046	.218	.243	.184	.012	.058	.093	.172	.202	.143	.300
11+	.207	.164	.349	.141	.017	.058	.093	.173	.201	.142	.300
F_2+	.007	.003	.006	.006	.015	.037	.110	.122	.120	.130	.293
F_5+	.015	.023	.032	.016	.018	.039	.111	.124	.121	.133	.297

Table 22. Population numbers ($x10^{-5}$) for area D, 1969-79.

Age	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
2	122	2840	694	40	4	21	1	18	-	3	4
3	94	100	2325	569	33	3	17	1	15	-	2
4	215	77	82	1901	465	27	3	13	-	12	-
5	34	176	63	65	1548	381	22	2	9	-	10
6	356	28	144	51	52	1241	309	17	1	7	-
7	4	290	22	118	41	42	974	240	14	1	6
8	4	3	231	17	96	33	31	700	183	11	-
9	5	3	2	183	13	79	26	22	501	138	9
10	4	4	2	1	148	11	63	17	16	363	101
11+	14	12	11	8	6	125	105	125	97	76	311
Total	852	3532	3577	2952	2406	1962	1549	1155	837	611	443
B_2+	181	396	541	626	594	514	425	324	241	185	146
B_5+	110	137	128	121	486	506	422	320	239	182	146

(B_2+ and B_5+: m tons x 10^{-2})

Table 23. Catch numbers ($x10^{-4}$) for areas E&F, 1969-79.

Age	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
2	-	-	-	-	7	-	1	106	1	-	-
3	1	-	1	1	-	-	42	2	13	-	1
4	-	2	3	163	2	1	3	9	1	10	1
5	-	2	1	13	453	13	2	2	13	3	3
6	7	3	1	6	26	955	206	3	19	7	1
7	-	31	4	3	47	15	882	236	9	1	4
8	-	3	31	8	14	8	12	478	102	-	-
9	-	2	3	36	4	4	49	8	427	74	3
10	-	2	1	7	19	1	26	23	6	308	27
11+	1	14	6	13	3	66	89	70	128	136	165
Total	9	59	51	250	575	1063	1312	937	719	539	205

Table 24. Fishing mortality for areas E&F, 1969-79.

Age	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
2	.000	.000	.000	.001	.104	.002	.070	.804	.025	.001	.002
3	.001	.000	.000	.000	.001	.002	.394	.115	.209	.004	.010
4	.000	.002	.013	.017	.001	.007	.075	.126	.108	.239	.050
5	.002	.003	.002	.075	.061	.010	.028	.076	.285	.520	.120
6	.003	.045	.001	.008	.205	.176	.204	.065	1.567	.227	.200
7	.002	.015	.073	.007	.091	.172	.245	.383	.311	.420	.200
8	.002	.027	.019	.195	.040	.019	.195	.203	.282	.014	.200
9	.007	.041	.042	.027	.143	.015	.165	.194	.281	.339	.200
10	.002	.138	.046	.112	.018	.068	.124	.106	.208	.338	.200
11+	.008	.070	.040	.089	.017	.069	.122	.103	.204	.333	.200
F_2+	.002	.003	.003	.017	.050	.121	.214	.223	.264	.308	.176
F_5+	.003	.018	.014	.030	.058	.125	.212	.206	.268	.331	.198

Table 25. Population numbers ($x10^{-5}$) for areas E&F, 1969-79.

Age	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
2	38	1573	277	12	8	18	2	21	3	9	6
3	134	31	1288	227	10	6	14	2	8	3	8
4	86	110	26	1055	185	8	5	8	1	5	2
5	10	71	90	21	849	152	6	3	6	1	3
6	280	8	58	73	16	654	123	5	3	4	-
7	14	229	6	47	60	11	449	82	4	-	2
8	5	11	185	5	38	45	7	288	46	2	-
9	2	4	9	148	3	30	36	5	192	28	2
10	11	1	3	7	118	2	24	25	3	119	17
11+	17	22	18	17	18	109	85	79	77	53	100
Total	597	2061	1959	1611	1304	1033	752	518	343	225	140
B_2+	142	258	354	383	350	290	222	154	107	72	46
B_5+	96	101	107	95	304	286	219	150	105	69	44

(B_2+ and B_5+: m tons x 10^{-2})

Table 26. Catch projection for areas 4&B, 1980-81, with M = 0.20, F_c = 0.40 and F_{opt} = 0.30.

CATCH PROJECTION FOR 1980

AGE	POPULATION NUMBERS	POPULATION WEIGHT	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHT	RESIDUAL NUMBERS	RESIDUAL WEIGHT
2	20000.	1600.	.003	54.	4.	16526.	1306.
3	225.	30.	.015	3.	.	182.	24.
4	2369.	476.	.075	155.	31.	1800.	362.
5	6105.	1477.	.180	914.	221.	4175.	1010.
6	2802.	729.	.300	681.	172.	1748.	442.
7	1180.	314.	.300	279.	74.	716.	190.
8	1914.	519.	.300	452.	122.	1161.	315.
9	3826.	1052.	.300	903.	248.	2321.	638.
10	12053.	3363.	.300	2845.	794.	7311.	2040.
11	25934.	8066.	.300	6123.	1904.	15730.	4892.
12	20369.	6335.	.300	4809.	1496.	12355.	3842.
13	1571.	489.	.300	371.	115.	953.	296.
14	6669.	2074.	.300	1574.	490.	4045.	1258.
15	2800.	873.	.300	663.	206.	1703.	530.
16	3718.	1156.	.300	878.	273.	2255.	701.
17	6702.	2084.	.300	1582.	492.	4065.	1264.
18	693.	216.	.300	164.	51.	421.	131.
19	220.	71.	.300	54.	17.	138.	43.
20	2529.	786.	.300	597.	186.	1534.	477.
TOTAL	121777.	31710.		23101.	6897.	78936.	19762.

CATCH PROJECTION FOR 1981

AGE	POPULATION NUMBERS	POPULATION WEIGHT	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHT	RESIDUAL NUMBERS	RESIDUAL WEIGHT
2	20000.	1600.	.003	54.	4.	16526.	1306.
3	16526.	2171.	.015	220.	29.	13167.	1751.
4	182.	37.	.075	12.	2.	138.	28.
5	1800.	435.	.180	269.	65.	1231.	298.
6	4175.	1056.	.300	986.	249.	2552.	641.
7	1748.	465.	.300	413.	110.	1060.	282.
8	716.	194.	.300	169.	46.	434.	118.
9	1161.	319.	.300	274.	75.	704.	194.
10	2321.	647.	.300	548.	153.	1408.	393.
11	7311.	2024.	.300	1726.	537.	4434.	1379.
12	15730.	4892.	.300	3714.	1155.	9541.	2967.
13	12355.	3842.	.300	2917.	907.	7493.	2330.
14	953.	296.	.300	225.	70.	578.	180.
15	4045.	1258.	.300	955.	297.	2453.	763.
16	1703.	530.	.300	402.	125.	1033.	321.
17	2255.	701.	.300	532.	166.	1368.	425.
18	4065.	1264.	.300	960.	298.	2465.	767.
19	421.	131.	.300	99.	31.	255.	79.
20	1534.	477.	.300	362.	113.	930.	289.
TOTAL	78936.	19762.		14870.	4443.	76066.	14552.

CATCH PROJECTION FOR 1980

AGE	POPULATION NUMBERS	POPULATION WEIGHT	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHT	RESIDUAL NUMBERS	RESIDUAL WEIGHT
2	10000.	800.	.003	27.	2.	8163.	653.
3	1804.	240.	.015	24.	3.	1455.	194
4	16911.	3230.	.075	1109.	212.	12845.	2453
5	1935.	409.	.180	290.	73.	1323.	335
6	2831.	738.	.300	668.	172.	1717.	443.
7	44.	12.	.300	10.	3.	26.	7
8	768.	207.	.300	181.	49.	466.	126.
9	231.	66.	.300	55.	16.	140.	40.
10	825.	237.	.300	195.	56.	500.	144
11	8183.	2635.	.300	1932.	622.	4963.	1598.
12	20020.	6704.	.300	4915.	1583.	12628.	4066.
13	1595.	514.	.300	377.	121.	968.	312.
14	1922.	619.	.300	454.	146.	1166.	375.
15	1639.	528.	.300	387.	125.	994.	320.
16	393.	127.	.300	93.	30.	238.	77.
17	4085.	1315.	.300	964.	311.	2478.	798.
18	54.	17.	.300	13.	4.	33.	11
19	802.	258.	.300	189.	61.	486.	157.
20	848.	273.	.300	200.	64.	514.	166.
TOTAL	75690.	19001.		12083.	3653.	51104.	12273.

CATCH PROJECTION FOR 1981

AGE	POPULATION NUMBERS	POPULATION WEIGHT	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHT	RESIDUAL NUMBERS	RESIDUAL WEIGHT
2	10000.	800.	.003	27.	2.	8163.	653.
3	8163.	1086.	.015	110.	15.	6584.	876.
4	1455.	278.	.075	95.	18.	1105.	211.
5	12845.	3250.	.180	1924.	487.	8784.	2222.
6	1323.	341.	.300	312.	81.	802.	207.
7	1717.	453.	.300	405.	107.	1042.	275.
8	26.	7.	.300	6.	2.	16.	4.
9	466.	133.	.300	110.	31.	283.	81.
10	140.	40.	.300	33.	10.	85.	24.
11	500.	161.	.300	118.	38.	303.	98.
12	4963.	1598.	.300	1172.	377.	3010.	969.
13	12628.	4066.	.300	2981.	960.	7659.	2466.
14	968.	312.	.300	228.	74.	587.	189.
15	1166.	375.	.300	275.	89.	707.	228.
16	994.	320.	.300	235.	76.	603.	194.
17	238.	77.	.300	56.	18.	145.	47.
18	2478.	798.	.300	585.	188.	1503.	484.
19	33.	11.	.300	8.	2.	20.	6.
20	1000.	322.	.300	236.	76.	607.	195.
TOTAL	61104.	14428.		8918.	2650.	42008.	9430.

Table 27. Catch projection for area C, 1980-81, with M = 0.20, F_t = 0.40 and F_{opt} = 0.30.

CATCH PROJECTION FOR 1980

AGE	POPULATION NUMBERS	POPULATION WEIGHT	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHT	RESIDUAL NUMBERS	RESIDUAL WEIGHT
2	1500.	120.	.003	4.	.	1224.	98.
3	301.	44.	.015	4.	1.	242.	35.
4	179.	39.	.075	12.	3.	136.	30.
5	12.	3.	.180	2.	.	8.	2.
6	653.	169.	.300	154.	40.	396.	103.
7	5.	1.	.300	1.	.	3.	1.
8	347.	96.	.300	82.	23.	210.	58.
9	28.	8.	.300	7.	2.	17.	5.
10	537.	164.	.300	127.	39.	326.	99.
11	6112.	2127.	.300	1443.	502.	3707.	1290.
12	15623.	5437.	.300	3688.	1284.	9476.	3298.
13	452.	157.	.300	107.	37.	274.	95.
14	329.	114.	.300	78.	27.	199.	69.
15	925.	322.	.300	218.	76.	561.	195.
16	121.	42.	.300	29.	10.	73.	25.
17	1372.	477.	.300	324.	113.	832.	290.
18	5.	2.	.300	1.	.	3.	1.
19	8.	3.	.300	2.	1.	5.	2.
20	33.	12.	.300	8.	3.	20.	7.
TOTAL	28542.	9330.		6290.	2160.	17714.	5704.

CATCH PROJECTION FOR 1981

AGE	POPULATION NUMBERS	POPULATION WEIGHT	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHT	RESIDUAL NUMBERS	RESIDUAL WEIGHT
2	1500.	120.	.003	4.	.	1224.	98.
3	1224.	179.	.015	17.	2.	988.	144.
4	242.	53.	.075	16.	3.	184.	41.
5	136.	34.	.180	20.	5.	93.	23.
6	8.	2.	.300	2.	.	5.	1.
7	396.	108.	.300	94.	25.	240.	65.
8	3.	1.	.300	1.	.	2.	1.
9	210.	68.	.300	58.	14.	128.	36.
10	17.	5.	.300	4.	1.	10.	3.
11	326.	113.	.300	77.	27.	190.	69.
12	3707.	1290.	.300	875.	305.	2148.	782.
13	9476.	3298.	.300	2237.	779.	5747.	2000
14	274.	95.	.300	65.	23.	166.	58.
15	199.	69.	.300	47.	16.	121.	42.
16	561.	195.	.300	132.	46.	340	118.
17	73.	25.	.300	17.	6.	44.	15.
18	832.	290.	.300	196.	68.	505.	176.
19	3.	1.	.300	1.	.	2.	1.
20	20.	7.	.300	5.	2.	13.	4.
TOTAL	19214.	5240.		3868.	1324.	12261.	3679.

Table 28. Catch projection for area D, 1980-81, with M = 0.20, F_t = 0.40 and F_{pat} = 0.30.

Table 23. Catch projection for areas E&F, 1980-81, with M = 0.20, F_t = 0.40 and F_{opt} = 0.30.

CATCH PROJECTION FOR 1980

AGE	POPULATION NUMBERS	POPULATION WEIGHT	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHT	RESIDUAL NUMBERS	RESIDUAL WEIGHT
2	1500.	120.	.005	4.	.	1494.	90.
3	451.	77.	.015	6.	1.	564.	65.
4	629.	140.	.075	41.	10.	538.	133.
5	158.	42.	.100	24.	6.	108.	29.
6	240.	66.	.300	57.	16.	146.	40.
7	28.	8.	.300	7.	2.	17.	5.
8	155.	46.	.300	36.	11.	91.	28.
9	16.	5.	.300	4.	1.	10.	3.
10	126.	42.	.300	30.	10.	76.	26.
11	1106.	399.	.300	261.	94.	671.	242.
12	4656.	1681.	.300	1099.	397.	2824.	1019.
13	85.	31.	.300	20.	7.	52.	19.
14	476.	172.	.300	112.	41.	289.	104.
15	338.	122.	.300	80.	29.	205.	74.
16	24.	9.	.300	6.	2.	15.	5.
17	1004.	363.	.300	237.	86.	609.	220.
18	45.	16.	.300	11.	4.	27.	10.
19	16.	6.	.300	4.	1.	10.	4.
20	57.	21.	.300	13.	5.	35.	12.
TOTAL	11112.	3374.		2050.	722.	7058.	2112.

CATCH PROJECTION FOR 1981

AGE	POPULATION NUMBERS	POPULATION WEIGHT	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHT	RESIDUAL NUMBERS	RESIDUAL WEIGHT
2	1500.	120.	.005	4.	.	1224.	98.
3	1224.	208.	.015	17.	3.	988.	168.
4	364.	86.	.075	24.	6.	276.	65.
5	478.	126.	.100	72.	19.	324.	86.
6	108.	30.	.300	26.	7.	66.	18.
7	146.	45.	.300	54.	16.	88.	26.
8	17.	5.	.300	6.	1.	10.	3.
9	94.	29.	.300	23.	7.	57.	17.
10	18.	5.	.300	5.	1.	6.	2.
11	76.	28.	.300	18.	7.	46.	17.
12	671.	242.	.300	158.	57.	387.	142.
13	2824.	1012.	.300	667.	241.	1713.	618.
14	52.	19.	.300	12.	4.	31.	11.
15	289.	104.	.300	68.	25.	175.	63.
16	205.	74.	.300	48.	17.	124.	45.
17	15.	5.	.300	4.	1.	9.	3.
18	609.	220.	.300	144.	52.	370.	133.
19	27.	10.	.300	6.	2.	16.	6.
20	44.	16.	.300	10.	4.	27.	10.
TOTAL	8954.	2887.		1541.	464.	5961.	1557.

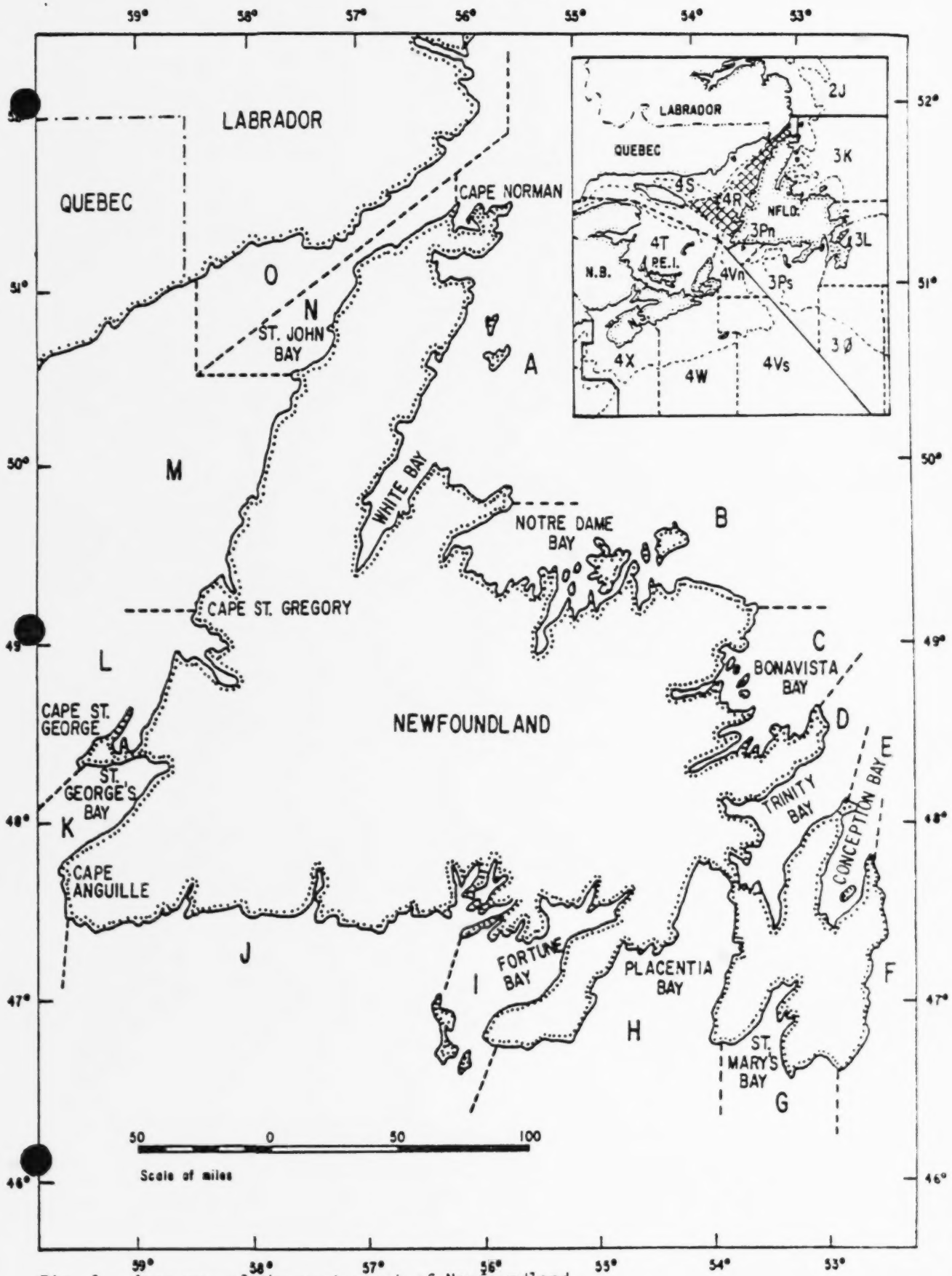

Fig. 1. Area map of the east coast of Newfoundland.

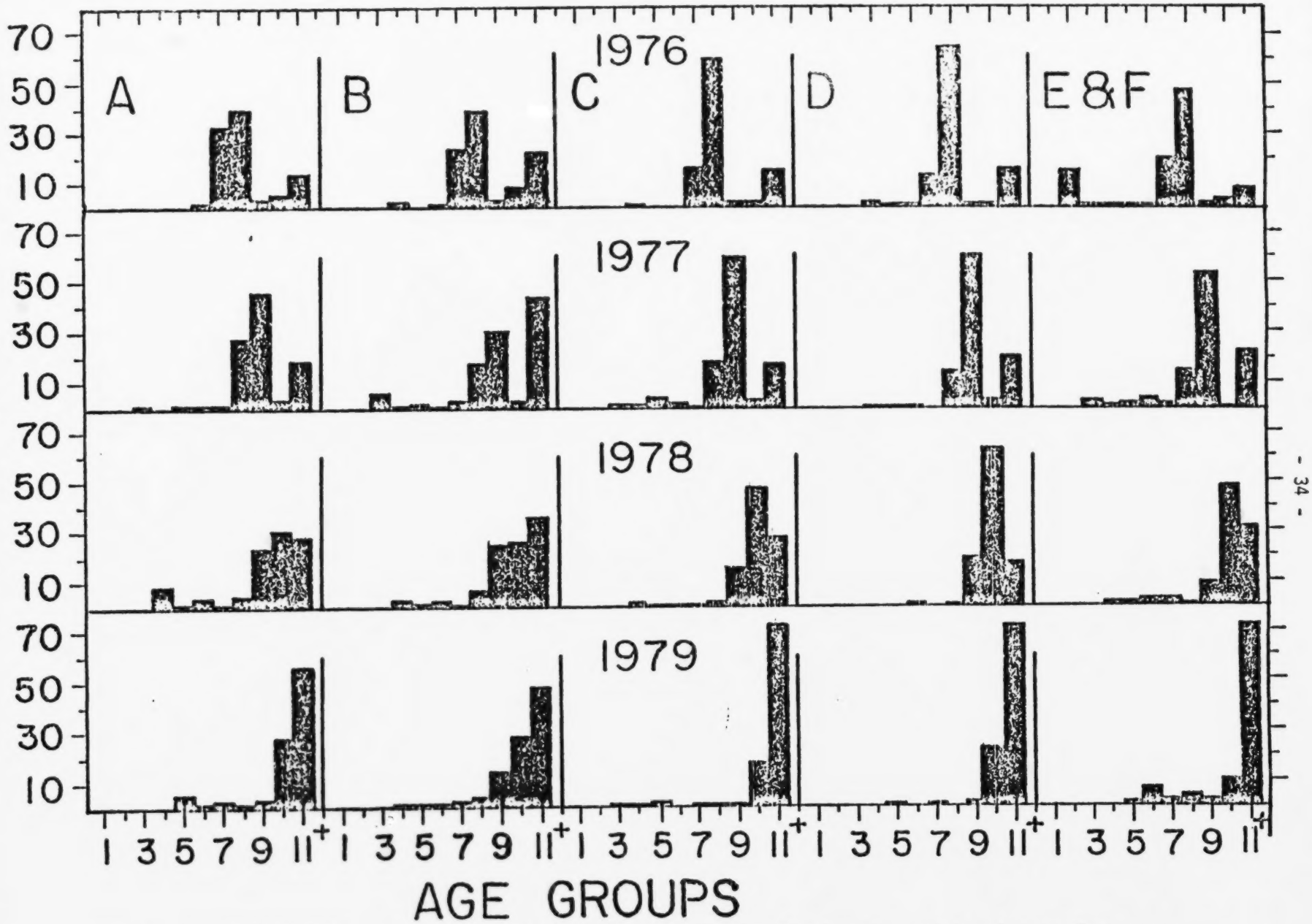

Fig. 2. Age distribution of herring in the landings from Newfoundland east coast herring stocks, 1976-79.

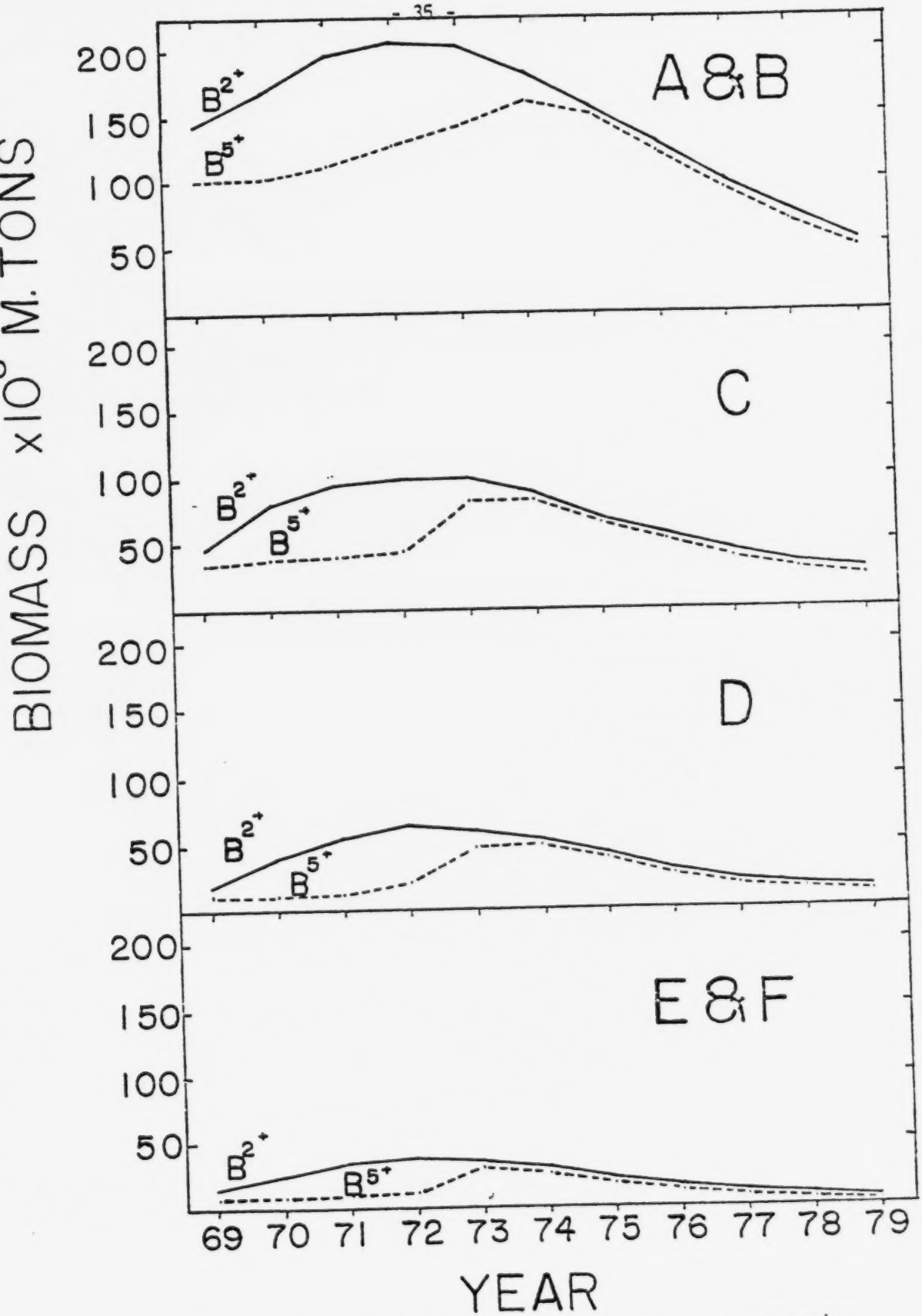

Fig. 3. Newfoundland east coast herring biomasses, spawning (B^{5+}) and total (B^{2+}), 1969-79.

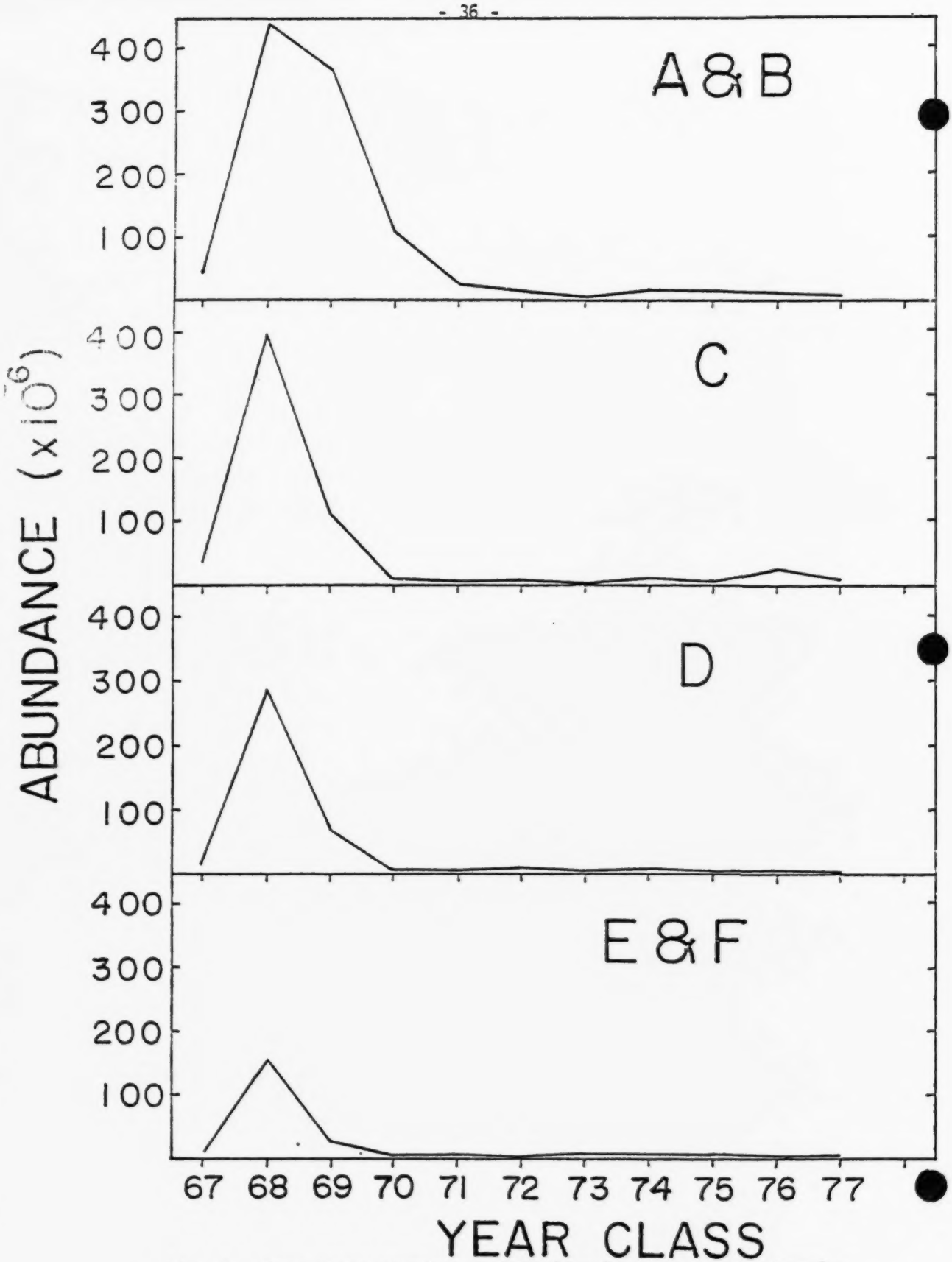

Fig. 4. Year-class abundance of Newfoundland east coast herring stocks, 1967-77.

App. 1. Cohort analysis for areas A&B, 1969-79, with M = 0.20 and F_t = 0.13.

	Population Numbers ($\times 10^{-5}$)										
Age	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
2	856	8367	7650	2577	657	304	139	291	368	110	9
3	3165	701	6850	6263	2110	538	249	114	237	301	90
4	1398	2591	574	5605	5125	1721	441	203	93	178	246
5	1815	1144	2121	469	4567	4182	1408	359	161	75	128
6	3475	1485	936	1735	381	3713	3396	1148	292	127	58
7	346	2844	1216	766	1420	305	2990	2731	933	237	95
8	119	283	2319	992	626	1156	239	2384	2143	756	189
9	475	97	232	1807	808	506	940	185	1803	1687	597
10	733	388	78	188	1467	658	401	762	140	1362	1284
11+	284	831	994	847	838	1864	2035	1951	2117	1696	2242
Total	12665	18731	22971	21249	17999	14947	12236	10127	8284	6530	4936
F_5+	.001	.002	.020	.006	.009	.014	.019	.048	.057	.080	.128
F_2+	.000	.001	.007	.003	.006	.011	.018	.046	.055	.076	.121
B_5+	1866	1879	2097	1838	2641	3248	3063	2620	2135	1690	1342
B_2+	2637	3163	3735	4004	4004	3690	3196	2699	2214	1774	1404

(B_5+ and B_2+: m tons x 10^{-2})

App. 2. Cohort analysis for areas A&B, 1969-79, with M = 0.20 and F_t = 0.25.

	Population Numbers ($x10^{-5}$)										
Age	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
2	597	5622	4788	1488	375	188	80	183	195	58	4
3	2068	489	4603	3920	1218	307	154	66	149	159	47
4	936	1692	400	3766	3207	991	251	125	53	106	130
5	1203	765	1386	327	3061	2612	810	204	97	43	69
6	2372	984	626	1133	265	2479	2110	659	164	75	32
7	232	1941	806	512	927	210	1980	1678	532	133	52
8	82	190	1580	655	418	753	161	1557	1281	429	104
9	323	66	155	1202	533	336	610	121	1127	982	328
10	468	265	53	125	972	433	262	491	88	807	706
11+	190	537	652	547	541	1205	1320	1251	1322	1002	1233
Total	8470	12552	15050	13676	11516	9523	7737	6336	5008	3794	2705
F_5+	.001	.004	.031	.008	.013	.021	.031	.078	.096	.141	.247
F_2+	.001	.001	.011	.005	.010	.018	.029	.075	.093	.135	.232
B_5+	1253	1261	1397	1215	1753	2110	1951	1644	1299	988	738
B_2+	1764	2116	2473	2613	2590	2365	2029	1692	1345	1035	770

(B_5+ and B_2+: m tons x 10^{-2})

App. 3. Cohort analysis for area C, 1969-79, with M = 0.20 and F_t = 0.33.

	Population Numbers ($\times 10^{-5}$)										
Age	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
2	309	3795	1058	77	23	62	7	78	35	233	20
3	361	253	3107	866	63	19	50	5	64	29	191
4	306	296	207	2543	709	52	15	38	4	50	23
5	76	251	242	169	2079	580	42	12	28	2	38
6	784	62	205	198	137	1695	475	34	9	17	1
7	10	642	51	168	162	109	1386	379	27	5	12
8	155	8	523	41	137	133	89	1102	279	22	4
9	16	126	7	425	33	112	108	72	786	184	13
10	103	13	103	6	345	27	91	85	53	482	124
11+	87	155	136	194	162	408	354	354	330	269	489
Total	2207	5601	5640	4688	3851	3195	2617	2158	1614	1293	913
F_5+	.001	.003	.005	.007	.008	.002	.029	.117	.234	.216	.322
F_2+	.001	.001	.001	.003	.006	.002	.030	.112	.221	.163	.235
B_5+	328	341	344	335	802	819	694	568	437	290	210
B_2+	459	734	882	942	948	837	704	582	449	322	242

(B_5+ and B_2+: m tons x 10^{-2})

App. 4. Conort analysis for areas E&F, 1969-79, with M = 0.20 and F_t = 0.15.

	Population Numbers ($x10^{-5}$)										
Age	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
2	41	1700	301	14	8	20	2	23	4	13	7
3	150	34	1392	247	11	6	16	2	9	3	10
4	97	123	28	1140	202	9	5	9	1	6	3
5	11	80	100	22	918	165	8	4	7	1	4
6	314	9	65	82	17	711	134	6	3	4	1
7	15	256	7	53	67	12	496	91	5	1	3
8	6	12	207	5	43	50	8	326	53	3	0
9	2	5	10	167	4	34	41	6	224	34	2
10	12	1	4	8	133	3	28	29	4	145	21
11+	20	26	21	19	21	124	97	92	90	65	130
Total	668	2246	2135	1757	1424	1133	834	587	400	275	183
F_5+	.002	.016	.013	.027	.053	.113	.189	.179	.225	.264	.148
F_2+	.002	.003	.003	.016	.046	.109	.191	.194	.221	.244	.132
B_5+	107	113	120	106	332	314	243	171	122	84	57
B_2+	159	284	387	419	382	319	247	175	125	88	60

(B_5+ and B_2+: m tons x 10^{-2})

App. 5. Cohort analysis for areas E&F, 1969-79, with M = 0.20 and F_t = 0.25.

	Population Numbers ($x10^{-5}$)										
Age	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
2	37	1497	262	10	7	17	2	20	3	8	4
3	125	30	1226	214	8	5	13	1	7	2	6
4	79	102	25	1003	175	7	4	7	1	4	2
5	10	65	83	20	807	143	6	3	5	1	3
6	260	8	53	68	15	620	116	4	3	3	0
7	13	212	6	43	55	10	421	77	3	0	2
8	5	10	171	5	35	41	7	265	41	2	0
9	2	4	8	137	3	28	33	4	173	25	2
10	9	1	3	7	109	2	22	22	3	104	14
11+	15	20	16	15	16	100	78	71	68	46	82
Total	554	1950	1853	1523	1232	973	702	476	308	195	114
F_5+	.003	.019	.016	.032	.062	.133	.229	.226	.303	.392	.247
F_2+	.002	.003	.003	.018	.053	.129	.231	.245	.298	.366	.219
B_5+	89	93	99	88	287	269	204	138	94	60	36
B_2+	131	242	334	362	330	273	208	141	96	62	38

(B_5+ and B_2+: m tons x 10^{-2})

CATCH PROJECTION FOR 1980

AGE	POPULATION NUMBERS	POPULATION WEIGHT	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHT	RESIDUAL NUMBERS	RESIDUAL WEIGHT
2	20000.	1600.	.003	54.	4.	16326.	1306.
3	694.	93.	.015	9.	1.	560.	74.
4	7341.	1476.	.025	401.	97.	5576.	1121.
5	19460.	4709.	.100	2914.	705.	13308.	3220.
6	9664.	2445.	.300	2202.	577.	5862.	1483.
7	4201.	1117.	.300	993.	264.	2548.	678.
8	6811.	1846.	.300	1608.	436.	4131.	1120.
9	13615.	3744.	.300	3214.	884.	8258.	2271.
10	42891.	11967.	.300	10126.	2825.	26015.	7258.
11	92288.	28702.	.300	21788.	6776.	55976.	17408.
12	72485.	22543.	.300	17112.	5322.	43964.	13673.
13	5590.	1739.	.300	1320.	410.	3391.	1054.
14	23731.	7380.	.300	5602.	1742.	14394.	4476.
15	9992.	3108.	.300	2359.	734.	6061.	1885.
16	13232.	4115.	.300	3124.	972.	8026.	2496.
17	23840.	7417.	.300	5630.	1751.	14464.	4498.
18	2467.	767.	.300	582.	181.	1496.	465.
19	812.	252.	.300	192.	60.	492.	153.
20	8999.	2799.	.300	2124.	661.	5458.	1697.
TOTAL	378122.	107817.		81514.	24402.	256305.	66339.

CATCH PROJECTION FOR 1981

AGE	POPULATION NUMBERS	POPULATION WEIGHT	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHT	RESIDUAL NUMBERS	RESIDUAL WEIGHT
2	20000.	1600.	.003	54.	4.	16326.	1306.
3	16326.	2171.	.015	220.	29.	13167.	1751.
4	560.	113.	.025	32.	7.	425.	86.
5	5576.	1349.	.100	835.	202.	3813.	923.
6	13308.	3367.	.300	3142.	795.	8071.	2042.
7	5862.	1559.	.300	1384.	368.	4555.	946.
8	2548.	690.	.300	602.	163.	1545.	419.
9	4131.	1136.	.300	975.	268.	2506.	689.
10	8258.	2304.	.300	1950.	544.	5009.	1397.
11	26015.	8091.	.300	6142.	1910.	15779.	4907.
12	55976.	17408.	.300	13215.	4110.	33951.	10559.
13	43964.	13673.	.300	10379.	3228.	26666.	8293.
14	3391.	1054.	.300	800.	249.	2057.	640.
15	14394.	4476.	.300	3398.	1057.	8730.	2715.
16	6061.	1885.	.300	1431.	445.	3676.	1143.
17	8026.	2496.	.300	1895.	589.	4868.	1514.
18	14464.	4498.	.300	3415.	1062.	8773.	2728.
19	1496.	465.	.300	353.	110.	908.	282.
20	5950.	1851.	.300	1405.	437.	5609.	1122.
TOTAL	256305.	70108.		51631.	15578.	163434.	43465.

App. 6. Catch projection for areas 4&B, 1980-81, with M = 0.20, F_t = 0.13 and F_{opt} = 0.30.

CATCH PROJECTION FOR 1980

AGE	POPULATION NUMBERS	POPULATION WEIGHT	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHT	RESIDUAL NUMBERS	RESIDUAL WEIGHT
2	20000.	1600.	.003	54.	4.	16326.	1306.
3	361.	48.	.015	5.	1.	291.	39.
4	3885.	765.	.075	250.	50.	2891.	581.
5	9962.	2411.	.100	1492.	361.	6813.	1649.
6	4839.	1224.	.300	1142.	289.	2935.	742.
7	2049.	545.	.300	484.	129.	1243.	331.
8	3322.	900.	.300	784.	213.	2015.	546.
9	6642.	1826.	.300	1568.	431.	4028.	1108.
10	20923.	5838.	.300	4940.	1378.	12690.	3541.
11	45020.	14001.	.300	10628.	3305.	27306.	8492.
12	35359.	10997.	.300	8348.	2596.	21447.	6670.
13	2727.	848.	.300	644.	200.	1654.	514.
14	11576.	3600.	.300	2733.	850.	7021.	2184.
15	4874.	1516.	.300	1151.	358.	2956.	919.
16	6455.	2007.	.300	1524.	474.	3915.	1218.
17	11633.	3618.	.300	2746.	854.	7056.	2194.
18	1204.	374.	.300	284.	88.	730.	227.
19	396.	123.	.300	93.	29.	240.	75.
20	1390.	1365.	.300	1036.	322.	2663.	828.
TOTAL	195538.	53608.		37906.	11933.	124220.	44163.

CATCH PROJECTION FOR 1981

AGE	POPULATION NUMBERS	POPULATION WEIGHT	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHT	RESIDUAL NUMBERS	RESIDUAL WEIGHT
2	20000.	1600.	.003	54.	4.	16326.	1306.
3	16326.	2171.	.015	230.	29.	13167.	1751.
4	291.	59.	.075	19.	4.	234.	44.
5	2891.	700.	.100	433.	105.	1922.	470.
6	6813.	1724.	.300	1608.	407.	4132.	1045.
7	2935.	781.	.300	693.	184.	1780.	473.
8	1243.	337.	.300	293.	80.	754.	204
9	2015.	554.	.300	476.	131.	1222.	336.
10	4028.	1124.	.300	951.	265.	2443.	682.
11	12690.	3947.	.300	2996.	932.	7697.	2394.
12	27306.	8492.	.300	6446.	2005.	16562.	5151.
13	21447.	6670.	.300	5063.	1575.	13008.	4045
14	1654.	514.	.300	390.	121.	1003.	312.
15	7021.	2184.	.300	1658	516.	4259.	1324.
16	2956.	919.	.300	698.	217.	1793.	558.
17	5915.	1840.	.300	1396.	434.	3587.	1159.
18	2956.	1194.	.300	1660.	518.	1300.	1531.
19	730	227.	.300	172.	54.	443	138.
20	2903	903.	.300	685.	213.	1761	548
TOTAL	144520.	36417.		25447.	7647.	95202.	27860.

Acc. 7. Catc. projection for areas 4&B, 1.0-cl, with M = 0.20, F_t = 0.35 and F_{opt} = 0.30.

App. 5. Catch projection for area C, 1980-81, with M = 0.20, F_q = 0.33, and F_{pot} = 0.30.

CATCH PROJECTION FOR 1980

AGE	POPULATION NUMBERS	POPULATION WEIGHT	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHT	RESIDUAL NUMBERS	RESIDUAL WEIGHT
2	10000.	800.	.003	27.	2.	8163.	653.
3	1640.	218.	.015	22.	3.	1522.	176.
4	15362.	2934.	.075	1007.	192.	11668.	2229.
5	1752.	443.	.180	262.	66.	1178.	303.
6	2549.	658.	.300	602.	155.	1546.	399.
7	39.	10.	.300	9.	2.	24.	6.
8	607.	186.	.300	162.	44.	417.	115.
9	207.	59.	.300	49.	14.	135.	36.
10	738.	212.	.300	174.	50.	447.	128.
11	7319.	2357.	.300	1728.	556.	4439.	1429.
12	18622.	5996.	.300	4396.	1416.	11295.	3637.
13	1427.	459.	.300	337.	108.	866.	279.
14	1719.	553.	.300	406.	131.	1043.	336.
15	1466.	472.	.300	346.	111.	889.	286.
16	352.	113.	.300	83.	27.	213.	69.
17	3654.	1176.	.300	863.	278.	2216.	714.
18	48.	16.	.300	11.	4.	29.	9.
19	717.	231.	.300	169.	55.	435.	140.
20	758.	244.	.300	179.	58.	460.	148.
TOTAL	69054.	17130.		10033.	3272.	46796.	11089.

CATCH PROJECTION FOR 1981

AGE	POPULATION NUMBERS	POPULATION WEIGHT	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHT	RESIDUAL NUMBERS	RESIDUAL WEIGHT
2	10000.	800.	.003	27.	2.	8163.	653.
3	8163.	1086.	.015	110.	15.	6584.	876.
4	1322.	253.	.075	87.	17.	1004.	192.
5	11660.	2952.	.180	1747.	442.	7980.	2019.
6	1190.	309.	.300	283.	73.	727.	187.
7	1546.	408.	.300	365.	96.	938.	248.
8	24.	6.	.300	6.	2.	14.	4.
9	417.	119.	.300	98.	28.	253.	72.
10	125.	36.	.300	30.	8.	76.	22.
11	442.	141.	.300	106.	34.	271.	87.
12	4439.	1429.	.300	1048.	337.	2692.	867.
13	11295.	3637.	.300	2666.	859.	6851.	2206.
14	866.	279.	.300	204.	66.	525.	169.
15	1043.	336.	.300	246.	79.	632.	204.
16	889.	286.	.300	210.	68.	539.	174.
17	213.	69.	.300	50.	16.	129.	42.
18	2216.	714.	.300	523.	168.	1344.	433.
19	29.	9.	.300	7.	2.	18.	6.
20	895.	288.	.300	211.	68.	543.	175.
TOTAL	56796.	13160.		8025.	2380.	49283.	8634

App. 9. Catch projection for areas E3F, 1980-81, with M = 0.20, F_t = 0.15 and F_{bar} = 2.30.

CATCH PROJECTION FOR 1980

AGE	POPULATION NUMBERS	POPULATION WEIGHT	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHT	RESIDUAL NUMBERS	RESIDUAL WEIGHT
2	1500.	120.	.003	4.	.	1224.	98.
3	602.	102.	.015	8.	1.	485.	83.
4	840.	198.	.075	55.	13.	638.	151.
5	213.	56.	.100	32.	8.	145.	38.
6	326.	90.	.300	77.	21.	198.	55.
7	39.	11.	.300	9.	3.	24.	7.
8	212.	63.	.300	50.	15.	128.	38.
9	22.	7.	.300	5.	2.	14.	4.
10	173.	57.	.300	41.	13.	105.	35.
11	1514.	547.	.300	358.	129.	919.	332.
12	6375.	2301.	.300	1505.	543.	3867.	1396.
13	117.	42.	.300	28.	10.	71.	26
14	651.	235.	.300	154.	56.	395.	143.
15	462.	167.	.300	109.	39.	280.	101.
16	33.	12.	.300	8.	3.	20.	7.
17	1375.	496.	.300	325.	117.	834.	301.
18	61.	22.	.300	14.	5.	37.	13.
19	22.	8.	.300	5.	2.	14.	5.
20	78.	28.	.300	18.	7.	47.	17.
TOTAL	14616.	4564.		2805.	988.	9445.	2848.

CATCH PROJECTION FOR 1981

AGE	POPULATION NUMBERS	POPULATION WEIGHT	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHT	RESIDUAL NUMBERS	RESIDUAL WEIGHT
2	1500.	120.	.003	4.	.	1224.	98.
3	1224.	208.	.015	17.	3.	988.	168.
4	485.	115.	.075	32.	8.	369.	87.
5	638.	168.	.100	96.	25.	436.	115.
6	145.	40.	.300	34.	9.	88.	24.
7	198.	58.	.300	47.	14.	120.	35.
8	24.	7.	.300	6.	2.	14.	4.
9	128.	42.	.300	30.	9.	78.	24.
10	14.	4.	.300	3.	1.	8.	3.
11	105.	38.	.300	25.	9.	63.	23
12	919.	332.	.300	217.	78.	552.	201.
13	3867.	1396.	.300	913.	330.	2345.	847.
14	71.	26.	.300	17.	6.	43.	16.
15	395.	143.	.300	93.	34.	240.	87.
16	280.	101.	.300	66.	24.	170.	61.
17	20.	7.	.300	5.	2.	12.	4.
18	834.	301.	.300	197.	71.	507.	183.
19	37.	13.	.300	9.	3.	23.	8.
20	47.	17.	.300	11.	5.	29.	10.
TOTAL	10945.	3138.		1825.	652.	7351.	2001.

CATCH PROJECTION FOR 1980

AGE	POPULATION NUMBERS	POPULATION WEIGHT	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHT	RESIDUAL NUMBERS	RESIDUAL WEIGHT
2	1500.	120.	.003	4.	.	1224.	98.
3	561.	61.	.015	5.	1.	291.	49.
4	503.	119.	.075	33.	8.	382.	90.
5	126.	35.	.100	19.	5.	86.	23.
6	109.	32.	.300	45.	12.	115.	32.
7	22.	6.	.300	5.	2.	13.	4.
8	120.	36.	.300	28.	8.	73.	22.
9	13.	4.	.300	3.	1.	8.	2.
10	90.	32.	.300	24.	8.	60.	20.
11	861.	311.	.300	203.	73.	525.	189.
12	3627.	1309.	.300	856.	309.	2200.	794.
13	67.	24.	.300	16.	6.	40.	15.
14	371.	134.	.300	87.	32.	225.	81.
15	263.	95.	.300	62.	22.	159.	58.
16	19.	7.	.300	4.	2.	12.	4.
17	782.	282.	.300	185.	67.	474.	171.
18	35.	13.	.300	8.	3.	21.	8.
19	13.	5.	.300	3.	1.	8.	3.
20	44.	16.	.300	10.	4.	27.	10.
TOTAL	9013.	2659.		1601.	563.	5940.	1671.

CATCH PROJECTION FOR 1981

AGE	POPULATION NUMBERS	POPULATION WEIGHT	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHT	RESIDUAL NUMBERS	RESIDUAL WEIGHT
2	1500.	120.	.003	4.	.	1224.	98.
3	1224.	208.	.015	17.	3.	980.	168.
4	291.	69.	075	19.	5.	221.	52.
5	382.	101.	.100	57.	15.	261.	69.
6	86.	24.	.300	20.	6.	52.	14.
7	115.	34.	.300	27.	8.	70.	20.
8	13.	4.	.300	3.	1.	8.	2.
9	73.	22.	.300	17.	5.	44.	14.
10	0.	3.	.300	2.	1.	5.	2.
11	60.	21.	.300	14.	5.	36.	13.
12	525.	189.	.300	123.	45.	317.	114.
13	2200.	794.	.300	519.	187.	1334.	482.
14	40.	15.	.300	10.	3.	24.	9.
15	225.	81.	.300	53.	19.	136.	49.
16	159.	58.	.300	38.	14.	97.	35.
17	12.	4.	.300	3.	1.	7.	3.
18	474.	171.	.300	112.	40.	288.	104.
19	21.	8.	.300	5.	2.	13.	5.
20	35.	12.	.300	8.	3.	21.	8.
TOTAL	7440.	1937.		1051.	363.	5148.	1260.

Age. 10. Catch projection for areas E3F, 1980-81, with M = 0.20, F_t = 0.25 and F_{opt} = 0.30.